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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 09/073,494 | 05/06/1998 | PAI-HUNG PAN | 2915.1US(96- | 9834 |
| 7590 | 04/21/2005 | | EXAMINER | |
| JOSEPH A WALKOWSKI TRASK BRITT & ROSSA PO BOX 2550 SALT LAKE CITY, UT 84110 | | | VU, HUNG K | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2811 | |

DATE MAILED: 04/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|------------------------|---------------------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 09/073,494 | PAN ET AL. <i>(em)</i> |
| | Examiner | Art Unit |
| | Hung Vu | 2811 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 27 January 2005.
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 45-64 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) 55-64 is/are allowed.
- 6) Claim(s) 45-54 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

| | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date: _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>3/10/05</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Request for Continued Examination

1 A request for continued examination (RCE) under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicants' submission filed on 01/27/05 has been entered. An action on the RCE follows.

Claim Objections

2. Claims 46-52, 58, 60 and 62-63 objected to because of the following informalities:
In claims 46-52, 60, and 62-63, line 1, "a" should be changed to "the", for clarity.
In claim 58, line 1, "an" should be changed to "the", for clarity.
Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 45 – 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tung (PN 5,728,625, of record) in view of Tomozawa et al. (PN 4,782,037, of record) and further in view of Kitamura (PN 6,465,295, of record).

Tung discloses, as shown in Figures 3A-4D, a method of forming a gate stack, comprising:

- forming a gate dielectric layer (303) on a silicon substrate (302);
- forming a doped polysilicon layer (304) on the gate dielectric layer;
- forming a metallic silicide film (305) on the doped polysilicon layer;
- forming a cap layer (307) on the metallic silicide film.

Tung discloses forming the cap layer by oxide. Tung does not disclose forming the cap layer by silicon nitride. However, Tomozawa et al. disclose a method of forming a cap layer by silicon oxide or silicon nitride. Col. 4, line 37-54 of Tomozawa et al.. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the cap layer of Tung by silicon nitride, such as taught by Tomozawa et al. since silicon oxide and silicon nitride are commonly used as the cap layer and they are interchangeable.

Tung and Tomozawa et al. do not disclose forming the cap layer at a sufficiently low temperature to maintain the metallic silicide film in an amorphous state. However, Kitamura disclose a method of forming a cap layer at a sufficiently low temperature. Col. 7, lines 8-11 of Kitamura. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the cap layer of Tung and Tomozawa et al. at a sufficiently low temperature, such as taught by Kitamura in order to increase the threshold voltage of the transistor.

Regarding claim 46, Tung, Tomozawa et al. and Kitamura disclose forming the metallic silicide film on the doped polysilicon layer comprises forming the metallic silicide film from a metal silicide selected from the group consisting of tungsten silicide, cobalt silicide, molybdenum silicide, and titanium silicide.

Regarding claim 47, Tung, Tomozawa et al. and Kitamura disclose forming the metallic silicide film on the doped polysilicon layer comprises forming an amorphous metallic silicide film on the doped polysilicon layer [Col. 6, lines 11-54, note that the examiner consider at temperature of 450 °C, the metallic silicide film is in amorphous state].

Regarding claim 48, Tung, Tomozawa et al. and Kitamura disclose forming the silicon nitride layer on the metallic silicide film at a sufficiently low temperature to maintain the metallic silicide film in an amorphous state comprises forming the silicon nitride layer at a temperature below about 600 °C.

Regarding claim 49, Tung, Tomozawa et al. and Kitamura disclose forming the silicon nitride layer on the metallic silicide film at a sufficiently low temperature to maintain the metallic silicide film in an amorphous state comprises forming the silicon nitride layer at a temperature ranging from approximately 400 °C to below about 600 °C.

Regarding claim 50, Tung, Tomozawa et al. and Kitamura disclose forming the silicon nitride layer on the metallic silicide film at a sufficiently low temperature to maintain the metallic

silicide film in an amorphous state comprises forming the silicon nitride layer by CVD [Col. 7, lines 7-11].

Regarding claim 51, Tung, Tomozawa et al. and Kitamura disclose forming the silicon nitride layer on the metallic silicide film at a sufficiently low temperature to maintain the metallic silicide film in an amorphous state comprises forming the silicon nitride layer by plasma-enhanced CVD [Col. 4, lines 37-54].

Regarding claim 52, since the silicon nitride is formed at low temperature, it is inherent that it would prevent formation of at least one silicon cluster in the metallic silicide film.

Regarding claim 53, Tung, Tomozawa et al. and Kitamura disclose the method further comprising:

forming and patterning a photoresist layer (not shown) on the silicon nitride layer;
etching the silicon nitride layer, the metallic silicide film, and the doped polysilicon layer;
removing the photoresist layer.

Regarding claim 52, since the silicon nitride is formed at low temperature with the amorphous metallic silicide film, it is inherent that the gate dielectric layer is substantially devoid of pitting.

Allowable Subject Matter

4. Claims 55-64 allowed.

Response to Arguments

5. Applicant's arguments with respect to claim 45 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hung K. Vu whose telephone number is (571) 272-1666. The examiner can normally be reached on Mon-Thurs 6:00-3:30, alternate Friday 7:00-3:30, Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (571) 272-1732. The Central Fax Number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Vu

April 15, 2005

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Hung Vu

Hung Vu

Primary Examiner